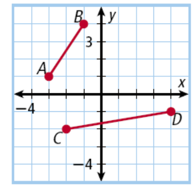


<u>Attendance Problems</u>. Use the slope formula to determine the slope of each line.

1. $\overline{AB}$

2. $\overline{CD}$

3. Simplify: $\left(7\sqrt{3}\right)\left(2\sqrt{3}\right)$

I can find the perimeters and areas of figures in a coordinate plane.

Common Core Standard: **CC.9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

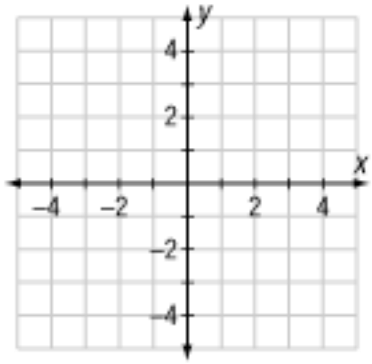
Remember!

The distance from (x_1, y_1) to (x_2, y_2) in a coordinate plane is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, and the slope of the line containing the points is $m = \frac{y_2 - y_1}{x_2 - x_1}$.

See pages 44 and 182.

<u>Video Example 2</u>.

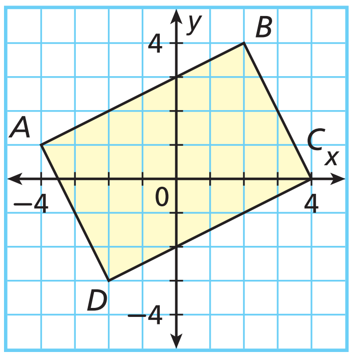
Draw and classify the polygon with vertices *A*(0, 1), *B*(3, 2), *C*(2, −1), *D*(−1, −2). Find the perimeter and area of the polygon.



2 Finding Perimeter and Area in the Coordinate Plane

Draw and classify the polygon with vertices $A(-4, 1)$, $B(2, 4)$, $C(4, 0)$, and $D(-2, -3)$. Find the perimeter and area of the polygon.

Step 1 Draw the polygon.



Step 2 $ABCD$ appears to be a rectangle. To verify this, use slopes to show that the sides are perpendicular.

slope of $\overline{AB}$: $\dfrac{4-1}{2-(-4)} = \dfrac{3}{6} = \dfrac{1}{2}$

slope of $\overline{BC}$: $\dfrac{0-4}{4-2} = \dfrac{-4}{2} = -2$

slope of $\overline{CD}$: $\dfrac{-3-0}{-2-4} = \dfrac{-3}{-6} = \dfrac{1}{2}$

slope of $\overline{DA}$: $\dfrac{1-(-3)}{-4-(-2)} = \dfrac{4}{-2} = -2$

The consecutive sides are perpendicular, so $ABCD$ is a rectangle.

Step 3 Let $\overline{CD}$ be the base and $\overline{BC}$ be the height of the rectangle. Use the Distance Formula to find each side length.

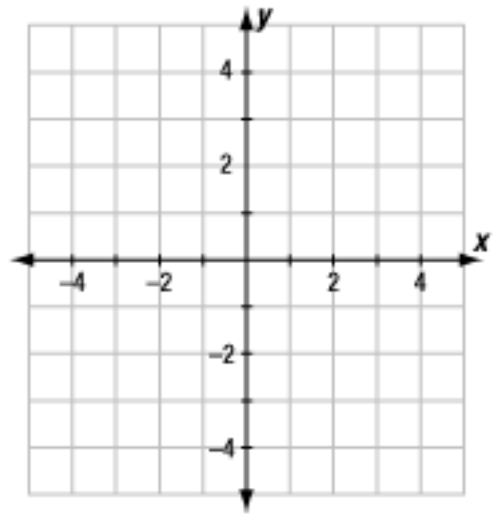
$b = CD = \sqrt{(-2-4)^2 + (-3-0)^2} = \sqrt{45} = 3\sqrt{5}$

$h = BC = \sqrt{(4-2)^2 + (0-4)^2} = \sqrt{20} = 2\sqrt{5}$

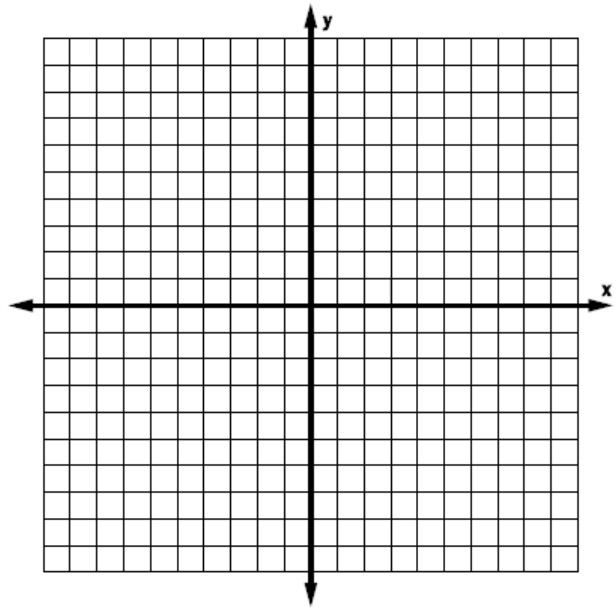
perimeter of $ABCD$: $P = 2b + 2h = 2\left(3\sqrt{5}\right) + 2\left(2\sqrt{5}\right) = 10\sqrt{5}$ units

area of $ABCD$: $A = bh = \left(3\sqrt{5}\right)\left(2\sqrt{5}\right) = 30 \text{ units}^2$.

Example 2. Draw and classify the polygon with vertices $E(-1, -1)$, $F(2, -2)$, $G(-1, -4)$, and $H(-4, -3)$. Find the perimeter and area of the polygon.

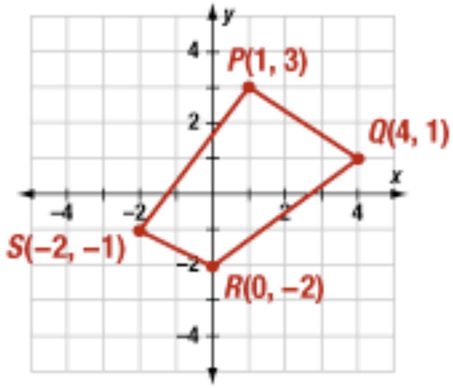


5. Guided Practice. Draw and classify the polygon with vertices *H*(–3, 4), *J*(2, 6), *K*(2, 1), and *L*(–3, –1). Find the perimeter and area of the polygon.



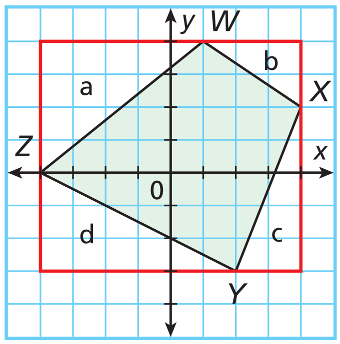
<u>Video Example 3</u>.

Find the area of the polygon with vertices $P(1, 3)$, $Q(4, 1)$, $R(0, -2)$, $S(-2, -1)$.



3 Finding Areas in the Coordinate Plane by Subtracting

Find the area of the polygon with vertices $W(1, 4)$, $X(4, 2)$, $Y(2, -3)$, and $Z(-4, 0)$.



Draw the polygon and enclose it in a rectangle.

area of the rectangle: $A = bh = 8(7) = 56 \text{ units}^2$

area of the triangles:

a: $A = \frac{1}{2}bh = \frac{1}{2}(5)(4) = 10 \text{ units}^2$

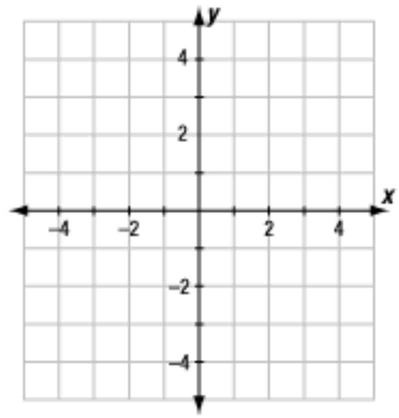
b: $A = \frac{1}{2}bh = \frac{1}{2}(3)(2) = 3 \text{ units}^2$

c: $A = \frac{1}{2}bh = \frac{1}{2}(2)(5) = 5 \text{ units}^2$

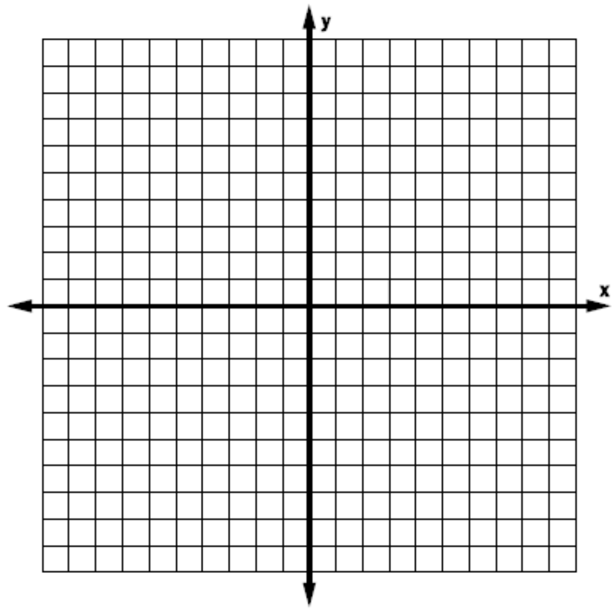
d: $A = \frac{1}{2}bh = \frac{1}{2}(6)(3) = 9 \text{ units}^2$

The area of the polygon is $56 - 10 - 3 - 5 - 9 = 29 \text{ units}^2$.

Example 3. Find the area of the polygon with vertices $A(-4, 1)$, $B(2, 4)$, $C(4, 1)$, and $D(-2, -2)$.

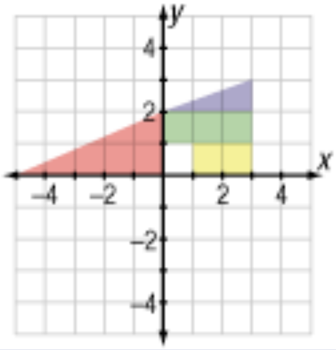


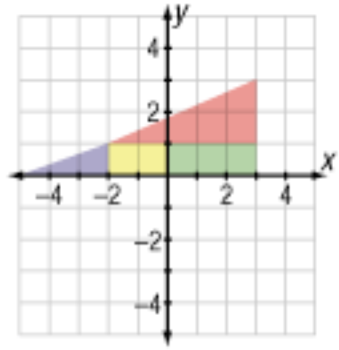
6. Find the area of the polygon with vertices $K(-2, 4)$, $L(6, -2)$, $M(4, -4)$, and $N(-6, -2)$.



Video Example 4.

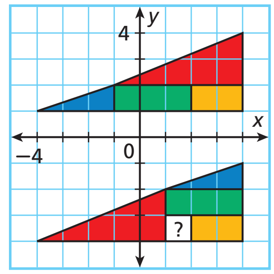
In the puzzle, the two figures are made up of the same pieces, but one figure appears to have a larger area. Use coordinates to show that the area does not change when the pieces are rearranged.





4 Problem-Solving Application

In the puzzle, the two figures are made up of the same pieces, but one figure appears to have a larger area. Use coordinates to show that the area does not change when the pieces are rearranged.



1 Understand the Problem

The parts of the puzzle appear to form two triangles with the same base and height that contain the same shapes, but one appears to have an area that is larger by one square unit.

2 Make a Plan

Find the areas of the shapes that make up each figure. If the corresponding areas are the same, then both figures have the same area by the Area Addition Postulate. To explain why the area appears to increase, consider the assumptions being made about the figure. Each figure is assumed to be a triangle with a base of 8 units and a height of 3 units. Both figures are divided into several smaller shapes.

3 Solve

Find the area of each shape.

Top figure	Bottom figure
red triangle:	red triangle:
$A = \frac{1}{2}bh = \frac{1}{2}(5)(2) = 5 \text{ units}^2$	$A = \frac{1}{2}bh = \frac{1}{2}(5)(2) = 5 \text{ units}^2$
blue triangle:	blue triangle:
$A = \frac{1}{2}bh = \frac{1}{2}(3)(1) = 1.5 \text{ units}^2$	$A = \frac{1}{2}bh = \frac{1}{2}(3)(1) = 1.5 \text{ units}^2$
green rectangle:	green rectangle:
$A = bh = (3)(1) = 3 \text{ units}^2$	$A = bh = (3)(1) = 3 \text{ units}^2$
yellow rectangle:	yellow rectangle:
$A = bh = (2)(1) = 2 \text{ units}^2$	$A = bh = (2)(1) = 2 \text{ units}^2$

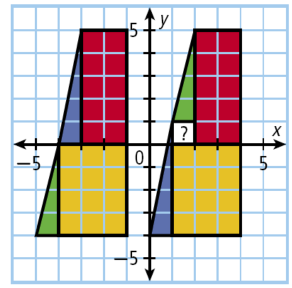
The areas are the same. Both figures have an area of
$5 + 1.5 + 3 + 2 = 11.5 \text{ units}^2$.

If the figures were triangles, their areas would be $A = \frac{1}{2}(8)(3) = 12 \text{ units}^2$. By the Area Addition Postulate, the area is only 11.5 units^2, so the figures must not be triangles. Each figure is a quadrilateral whose shape is very close to a triangle.

4 Look Back

The slope of the hypotenuse of the red triangle is $\frac{2}{5}$. The slope of the hypotenuse of the blue triangle is $\frac{1}{3}$. Since the slopes are unequal, the hypotenuses do not form a straight line. This means the overall shapes are not triangles.

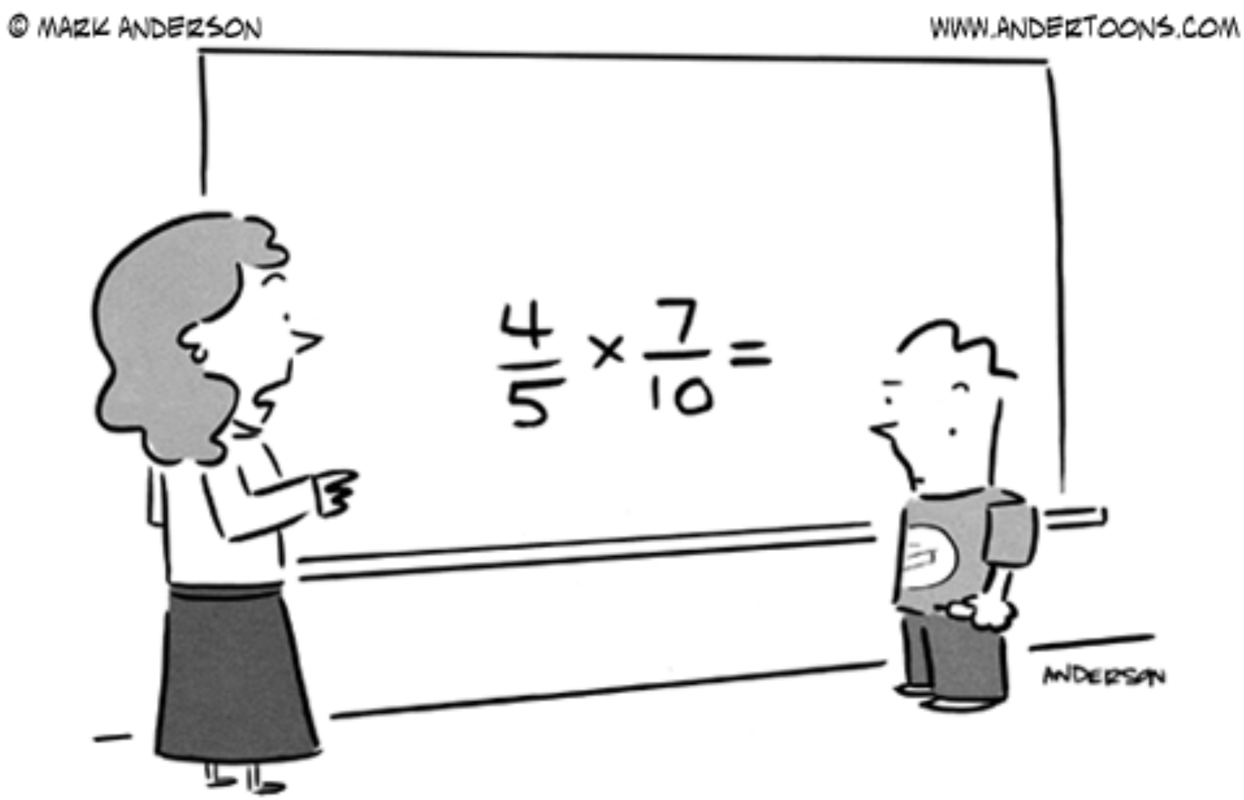
Example 4. Show that the area does not change when the pieces are rearranged.



10-4 Perimeter and Area in the coordinate plane *(p 708)* 13, 15-18, 20, 21-23, 27.

Q: What happened to the plant in the math classroom?
A: It grew square roots!

"Kindness is never wasted. If it has no effect on the recipient, at least it benefits the bestower."—*Biologist, S.H. Simmons*



"Actually, ninjas multiply fractions all the time. They just never talk about it. Because they're ninjas."